IN THE SPECIFICATION:

Page 1, immediately following the title, please insert the following:

This is the U.S. national phase of International Application No. PCT/GB03/02734 filed June 26, 2003, the entire disclosure of which is incorporated herein by reference.

The heading beginning on page 1, line 3 has been changed as follows:

Field of the ~~Invention~~ Disclosure

The paragraph beginning on page 1, line 4 has been changed as follows:

The ~~present invention~~ disclosure relates to a device, which enables both the display of information and the input of information. The device combines light emitting elements to provide an information display function and light sensing elements to provide an information-input function. In particular the ~~invention~~ disclosure relates to a combined information display and information input device based on organic materials wherein an organic light emitting material is used to provide the light emitting function and an organic light sensing material is used to provide the light sensing function. Methods of manufacture of such devices are also the subject of the ~~present invention~~ disclosure.

The paragraphs beginning on page 1, line 27 have been changed as follows:

The ~~1990's~~ 1990s saw the growth of a display technology based on organic light emitting materials. Light emitting devices based on organic light emitting materials fall into two broad classes, those based on polymeric light emitting materials, as disclosed in ~~W090/13148~~ WO 90/13148, and those devices based on low molecular weight light emitting materials, so called small molecules, such as disclosed in ~~US4530507~~ US 4530507. At around the

same time it was appreciated that the same semiconductive organic materials which provide the light emitting material in organic light emitting devices could also be used to detect light, see in particular the disclosure of the light sensing properties of light emitting polymers in ~~US5331183~~ US 5331183 and ~~US5523555~~ US 5523555.

It has been proposed to use this dual operating function of light emitting polymers to provide a device capable of both the display and the input of information. ~~US5929845~~ US 5929845 discloses a scanner based on a matrix of organic light emitting devices with the devices emitting light onto the surface of the image to be scanned, light reflected from this image is detected by the display allowing information about the scanned image to be stored in a suitable information storage means and if desired displayed by means of the matrix of light emitting devices. This scanner device comprises a single matrix of light emitting polymer devices with each device functioning as both a light emitter and a light detector. US5504323 US 5504323 also suggests using a single matrix of organic light emitting devices with each device acting as both light emitter and light detector. ~~GB2315594~~ GB 2315594 discloses a scanning device where organic light emitting devices are used to provide a light source, light from which is reflected from the image to be scanned, this reflected light is detected by light emitting polymer based sensors.

The heading beginning on page 2, line 29 has been changed as follows:

Summary of the ~~Invention~~ Disclosure

The paragraphs beginning on page 2, line 30 have been changed as follows:

The ~~inventors of the present application have developed~~ disclosure provides a combined information display and information input device which overcomes the problems of the prior art displays. The combined information display and information input device of

the ~~present invention~~ disclosure combines efficient light emitting devices and efficient light sensing devices providing a device which can be optimised for both the display of information and the input of information. The light emitting devices and light sensing devices of the ~~present invention~~ disclosure can be optimised independently, this allows for the development of displays with better signal to noise ratios and displays which can, for example, display video images whilst still retaining a light sensing function.

Although the light emitting and light sensing devices can be optimised separately the similarity in the structures of the light emitting and light sensing devices of the ~~present invention~~ disclosure allows the displays ~~of the present invention~~ to be manufactured using a relatively limited number of steps. Taking the similarities in structure of the light emitting and light sensing devices ~~of the present invention~~ into account the inventors ~~of the present application have developed~~ disclosure provides an efficient and flexible method for the production of such devices. Further the ~~present invention~~ disclosure provides a range of device architectures and driving schemes.

In a first embodiment the ~~present invention~~ disclosure provides a combined information display and information input device comprising a matrix of independently addressable light emitting devices and a plurality of light sensing devices, ~~said~~ the light emitting devices comprising organic light emitting diodes comprising organic light emitting material positioned between a low work function electrode and a high work function electrode characterised in that ~~said~~ the light sensing devices comprise organic photovoltaic devices comprising at least an organic electron donor and at least an organic electron acceptor positioned between a high work function electrode and a low work function electrode.

The paragraph beginning on page 5, line 3 has been changed as follows:

The organic light emitting device comprises a low work function electrode, preferably having a work function of less than 3.5 eV. The low work function electrode provides for the injection of electrons (negative charge carriers) into the layer of organic light emitting material. Preferred materials for forming the low work function electrode include Mg, Ca, Ba and Al. In order to further facilitate the injection of electrons into the layer of organic light emitting material it is preferred to provide a layer of insulating material positioned between said layer of organic light emitting material and said low work function electrode. The layer of insulating material should be sufficiently thin such that it allows charge injection from the low work function electrode into the layer of organic light emitting material, preferably the layer of insulating material has a thickness of between 1 nm and 90 nm. Preferred material for the layer of insulating material include alkali or alkaline earth metal fluorides, such as LiF or BaF_2.

The paragraphs beginning on page 5, line 20 have been changed as follows:

In a particularly advantageous embodiment the ~~present invention~~ disclosure provides a combined information display and information input device wherein said organic photovoltaic devices are sensitive to light in a non-visible region of the electromagnetic spectrum. Preferably the light sensing devices are sensitive to light in the infrared region of the electromagnetic spectrum i.e. light having a wavelength greater than 700 nm.

The ~~present invention~~ disclosure is also directed to multicolour information displays wherein ~~said~~ the organic light emitting devices comprise a first group of organic light emitting devices and a second group of organic light emitting devices, ~~said~~ the first group of organic light emitting devices emitting light of a first colour and ~~said~~ the second group of said organic light emitting devices emitting light of a second colour. Preferably the device

comprises a third group of light emitting devices emitting light of a third colour. The first, second and third ~~colours~~ colors are most preferably selected from ~~amongst~~ red, green and blue.

The ~~present invention~~ disclosure is further directed to displays emitting light in a non-visible region of the electromagnetic spectrum wherein said organic light emitting devices comprise both a group of light emitting devices emitting light of a colour in the visible range of the electromagnetic spectrum and a group of light emitting devices emitting light in a ~~non visible~~ non-visible region of the electromagnetic spectrum. Preferably light emitted in a non-visible region of the electromagnetic spectrum is emitted as light in the infrared region of the electromagnetic spectrum i.e. light of a wavelength greater than 700 nm.

The paragraph beginning on page 8 line 5 has been changed as follows:

A suitable method for driving the combined displays of the ~~present invention~~ disclosure involves applying a regular scanning signal to the row electrodes, addressing each row electrode in turn, ~~whilst~~ while supplying a signal to the column electrodes of the light emitting devices from which light emission is required. In a similar manner a scanning signal may be applied to the row electrodes of the light sensing devices and the signal generated by incident light at a given light sensing device may be read at the column electrode. In such a method it is preferred to use a clock signal generating means for applying the scanning signal to the row electrodes. The role of the clock signal generating means is to provide a scanning signal to the combined row selector driver or to both the light emitting device row selector driver and the light sensing device row selector driver according to whether the light emitting and light sensing devices are addressed by a single set of row electrodes or by two separate sets of row electrodes.

The paragraph beginning on page 8, line 31 has been changed as follows:

The ~~present invention~~ disclosure is also directed to a method for preparing a combined information display and information input device by means of selectively depositing the organic materials which constitute the light emitting and light sensing devices onto a patterned substrate. Accordingly the present invention is directed to a method of preparing a combined information display and information input device comprising;

a) providing a substrate,

b) providing a patterned layer of conducting material having a high work function,

c) providing a patterned layer of organic light emitting material and a patterned layer of organic photovoltaic material said organic photovoltaic material comprising at least an organic electron donor and at least an organic electron acceptor,

d) providing a layer of a conducting material having a low work function.

The paragraph beginning on page 10, line 9 has been changed as follows:

The ~~present invention~~ disclosure also provides a method for preparing a combined information display and information input device where rows of light emitting devices and rows of light sensing devices are addressed by separate row electrodes. This method comprises;

a) providing a substrate,

b) providing a patterned layer of conducting material having a high work function,

c) providing a first layer of insulating material over said layer of conducting material said first layer of insulating material being patterned to form a series of wells,

d) providing a second layer of insulating material, said second layer of insulating material being patterned to form a series of parallel banks over said first layer of insulating material,

e) optionally depositing by means of ink-jet printing a layer of hole transporting material into a selection of said wells,

f) depositing by means of ink-jet printing a third layer of insulating material in a first selection of said wells,

g) depositing by means of ink-jet printing a layer of an organic light emitting material into a second selection of said wells,

h) depositing by means of ink-jet printing a layer of organic photovoltaic material comprising at least an organic electron donor and at least an organic electron acceptor into a third selection of said wells,

1) depositing a layer of a conducting material having a low work function over said layer of organic light emitting material and said layer of organic photovoltaic material, wherein steps e), f), g) or h) may be carried out in any order provided that when present the layer of hole transporting material is deposited prior to the deposition of the organic light emitting material or the organic photovoltaic material.

The paragraph beginning on page 11, line 5 has been changed as follows:

The ~~present invention~~ disclosure is further directed to the use of a combined information display and information input device according to the ~~present invention~~ disclosure as a touch screen and further to the use of a combined information display and information input device according to the ~~present invention~~ disclosure as an image scanner. The ~~present invention~~ disclosure is further directed to a mobile communication device comprising a combined information display and information input device according to the ~~present invention~~ disclosure.

The heading beginning on page 11, line 11 has been changed as follows:

Detailed description ~~of the invention~~

The paragraph beginning on page 12, line 17 has been changed as follows:

The combined information display and information input device of the ~~present invention~~ disclosure has a matrix of light emitting devices, also known as pixels, which can be turned on or off to display an image. The display also has a set of light sensing devices, these are organic photovoltaic devices which are herein referred to as photodetector pixels. The photodetector pixels are distributed over the display and provide a means of detecting light intensity incident on the display surface. The light intensity distribution on the display's surface will be modulated by, for example, approaching a pointing device toward the screen. In this manner a user may input information into the display device. The pointing device may act to decrease light intensity at a point on the surface of the display by casting a shadow over certain of the photodetector pixels or may act to increase light intensity at a point on the surface of the display by reflecting light emitted from the display pixels back toward the photodetector pixels. The light intensity at each photodetector pixel may then be read to yield information on the spatial location of the pointing device on the display surface, the location will be detectable as either an increase or decrease in light intensity at a particular location on the display surface.

The paragraph beginning on page 15, line 6 has been changed as follows:

Figure 3 shows the typical structure of a light emitting pixel 300 and a photodetector pixel 310 according to the ~~present invention~~ disclosure. For clarity Figure 3 shows the two pixels to be of the same size and proximate to each other, clearly in a practical device the two types of pixel may be of different size and may be distributed such that, for example, the display has only a single photodetector pixel for every three or more light emitting pixels. The display comprises a substrate 301, suitable substrates include glass, ceramics and plastics such as acrylic resins, polycarbonate resins, polyester resins, polyethylene terephthalate resins and cyclic olefin resins. The substrate may be transparent, semi-transparent or, in cases where light is to be emitted and detected from the opposite side of the device, opaque. The substrate may be rigid or flexible and may comprise a composite material such as, for example, the glass and plastic composite disclosed in ~~EP0949850~~ EP 0949850.

The paragraphs beginning on page 15, line 30 have been changed as follows:

The light emitting pixel 300 comprises a layer of hole transporting material 304. Suitable hole transporting materials include polystyrene sufonic acid doped polyethylene dioxythiophene (PEDOT:PSS), as disclosed in ~~WO98105187~~ WO 98105187, polyaniline or TPD (N,N'-diphenyl-N,N'-bis(3-methylphenyl)[1,1'-biphenyl]-4,4'diamine). Over the layer of hole transporting material is a layer of light emitting material 305. The light emitting material may be a polymeric light emitting material, such as disclosed in Bernius et at Advanced Materials, 2000, 12, 1737 or a low molecular weight light emitting material such aluminum trisquinoline, as disclosed in ~~US5294869~~ US 5294869. The light emitting material may comprise a blend of a light emitting material and a fluorescent dye or may comprise a layered structure of a light emitting material and a fluorescent dye. Light emitting polymers include polyfluorene, polybenzothiazole, polytriarylamine, poly(phenylenevinylene) and

polythiophene. Preferred light emitting polymers include homopolymers and copolymers of 9,9-di-n-octylfluorene (F8), N,N-bis(phenyl)-4-sec-butylphenylamine (TFB) and benzothiadiazole (BT). A layer of electron transporting or hole blocking material may be positioned over the layer of light emitting material if required to improve device efficiency.

The paragraph beginning on page 17, line 1 has been changed as follows:

The light sensing device 310 is an organic photovoltaic device known as an organic heterojunction device, such devices are disclosed in ~~US5454880~~ US 5454880. A typical organic heterojunction photovoltaic device comprises a layer of high work function material 302 on a substrate 301. Since the present display comprises a combination of light emitting devices and light detecting devices it is most practical to provide both types of devices on a single substrate and to address both types of devices using a single conductive material of high work function. Therefore the description of suitable materials for the substrate and high work function material of the light emitting device also apply to those of the light detecting device.

The paragraph beginning on page 17, line 17 has been changed as follows:

A variety of structures of the organic photovoltaic devices are possible. The electron donor and electron acceptor may comprise polymers or low molecular weight compounds. The electron donor and acceptor may be present as two separate layers, as disclosed in ~~W099/49525~~ W0 99/49525, or as a blend, as disclosed in ~~US5670791~~ US 5670791, a so called bulk heterojunction. The electron donor and acceptor may be selected from perylene derivatives such as N, N'-diphenylglyoxaline-3, 4, 9, 10-perylene tetracarboxylic acid diacidamide, fullerenes (C_{60}), fullerene derivatives and fullerene containing polymers and semiconducting organic polymers such as polyfluorenes, polybenzothiazoles,

polytriarylamines, poly(phenylenevinylenes), polyphenylenes, polythiophenes, polypyrroles, polyacetylenes, polyisonaphthalenes and polyquinolines. Preferred polymers include MEH-PPV (poly(2-methoxy, 5-(2'ethyl)hexyloxy-p-phenylenevinylene)), MEH-CN-PPV (poly (2,5-bis (nitrilemethyl)-1methoxy-4- (2'-ethyl-hexyloxy) benzene-co-2,5-dialdehyde-l-methoxy4- (2'-ethylhexyloxy) benzene)) and CN-PPV cyano substituted PPV, polyalkylthiophenes, such as poly(3-hexylthiophene), POPT poly(3 (4-octylphenyl)thiophene) and poly(3-dodecylthiophene), polyfluorenes, such as poly(2,7-(9,9-di-n-octylfluorene), poly(2,7-(9,9-di-n-octylfluorene)-benzothiadiazole) and poly(2,7-(9,9-di-n-octylfluorene)-(4,7-di-2-thienyl-(benzothiazole)). Typical device structures include a blend of N, N'diphenylglyoxaline-3, 4, 9, 10-perylene tetracarboxylic acid diacidamide and poly(3-dodecylthiophene), a layered structure comprising a layer of MEH-PPV and a layer of C_{60}, a blend of MEH-PPV and C_{60}, a layered structure comprising a layer of MEH-CN-PPV and a layer of POPT, a blend comprising MEH-PPV and CN-PPV and a blend comprising poly(3-hexylthiophene) and poly(2,7-(9,9-di-n-octylfluorene)-(4,7-di-2-thienyl-(benzothiazole)). A cathode 314 of material of low work function is provided over the layer of organic photovoltaic material. Materials suitable for the cathode of the light emitting device are also suitable for the cathode of the photovoltaic device.

The paragraph beginning on page 18, line 8 has been changed as follows:

Organic heterojunction photovoltaic devices operate in the manner described as follows. The electrodes of different work function set up an internal electric field across the device. Absorption of light by the materials of the organic layer generates bound electron-hole pairs, termed excitons. Excitons generated on the material of lower electron affinity dissociate by transfer of an electron to the material of higher electron affinity, the material of lower electron affinity is sometimes referred to as the electron donor or simply donor.

Excitons generated on the material of higher electron affinity dissociate by transfer of a hole to the material of lower electron affinity, the material of higher electron affinity is sometimes referred to as the electron acceptor or simply acceptor. The electrons and holes generated by dissociation of the exictons then move through the device, with electrons moving to the lower work function cathode and holes moving to the higher work function anode. In this way light incident on the device generates a current which may be used in an external circuit. In the devices of the ~~present invention~~ disclosure the current generated at the photovoltaic device is measured using suitable circuitry and this provides a measurement of the light intensity incident on the photovoltaic device. In this way the photovoltaic device can be considered to operate as a photodetector, detecting light incident on the device. Applying an additional potential difference between the electrodes of the organic photodetector increases its sensitivity by increasing charge carrier mobility, improving charge transport and reducing charge carrier recombination.

The paragraphs beginning on page 20, line 3 have been changed as follows:

The similarity in device structure of the organic light emitting device and the organic photodetector is an advantage of the combined information display and information input device of the ~~present invention~~ disclosure. The two devices share a number of features such as the nature of the electrodes and the use of a hole transporting layer. These similarities allow the devices to be prepared in a very efficient manner with a limited number of steps and with the same manufacturing steps being carried out to form both the light emitting devices and the photodetectors. In the combined information display and information input devices of the prior art, such as a combination of LCDs and semiconductor photodetectors, the display function and the light detection function are provided by devices which are

substantially different in structure and so the production of these devices requires a greater number of steps.

A significant advantage of the device of the ~~present invention~~ disclosure is that the preferred organic materials which constitute the device, in particular conducting and semiconducting polymers, are soluble and can be deposited using solution deposition techniques and in particular printing techniques. Printing techniques do not require expensive and complex equipment, are potentially environmentally benign and may be applied to a great range of substrates such as flexible substrates. The following gives a detailed description of the use of ink jet printing to prepare devices according to the ~~present invention~~ disclosure comprising light emitting and light detecting materials based on polymers. Clearly other selective printing methods such as flexographic printing could also be used.

Figure 4 illustrates a preferred method of preparing a combined information display and information input device 400 according to the ~~present invention~~ disclosure. Figure 4(a) shows a cross sectional view of a glass substrate 401 suitable for a device of the ~~present invention~~ disclosure. The substrate is coated with a layer of ITO 402 to form the anode of the eventual organic electronic devices. ITO may be deposited by sputtering or any other suitable method known to those in the art. The ITO layer on the substrate is then patterned using photolithography, wherein the layer of ITO is coated with a photoresist, patterned, for example using a UV source and a photomask, and developed using the appropriate developing solution, exposed ITO is then removed by chemical etching, leaving a patterned layer of ITO. Typically the ITO is patterned to form a series of parallel stripes.

The paragraphs beginning on page 23, line 12 have been changed as follows:

A cathode material 408 is then deposited over the light emitting material and the light detecting material. The cathode material is deposited by means of vapour deposition. Where appropriate multilayer cathodes may be deposited, for example the cathodes comprising a layer of alkali or alkaline earth metal fluorides and layers of metals as discussed above. A particularly preferred cathode comprises LiF/Ca/Al, with a layer of LiF of thickness from 1nm to 10nm, a layer of Ca of thickness of 1nm to 25nm and a layer of Al of thickness 10nm to 500nm. It is a notable advantage of the ~~present invention~~ disclosure that a single cathode may be deposited over both the light emitting devices and the photovoltaic devices without the need for carrying out multistep metal deposition processes.

The device is then encapsulated, this may be carried out by means of enclosing the device in a metal can or glass cover to protect the device from the environment, an oxygen or moisture absorbent may be included within the metal can or glass cover, such a technique is disclosed in ~~US6080031~~ US 6080031. Alternatively devices may be encapsulated by laminating an impermeable composite material over the device as is disclosed in ~~WO00/36661~~ WO 00/36661. Given the similarity in structure of the light emitting devices and photovoltaic devices of the ~~present invention~~ disclosure the same encapsulation system may be used to protect both types of device devices from the environment since the different devices are likely to be susceptible to similar environmental degradation mechanisms.

The paragraph beginning on page 25, line 22 has been changed as follows:

The light emitting pixels of the combined information display and information input device of the ~~present invention~~ disclosure are arranged in the form of a matrix of independently addressable light emitting devices. Typically this matrix will comprise a series of light emitting ~~device~~ devices addressing column electrodes and a series of light emitting

~~device~~ devices addressing row electrodes with the light emitting devices positioned at the intersection of the row and column electrodes. Generally the column and row electrodes will have an orthogonal arrangement relative to each other. Although the row and column electrodes may be formed on the cathode and anode of the light emitting devices using a separate conductive layer, it is preferred that the anode and cathode of the light emitting device are themselves used to form the row and column electrodes respectively. In such an embodiment the anode will be formed as a continuous strip on the substrate and will serve to connect adjacent devices and the cathode will be formed as a continuous strip over the layer of light emitting material also connecting adjacent devices, with the cathode and anode in an orthogonal arrangement. Generally the row addressing electrodes will be formed from or in contact with the anode or high work function electrode and the column addressing electrodes will be formed from or in contact with the cathode or low work function electrode. The matrix of light emitting devices will typically have a resolution of 100-200 pixels per inch.

The paragraph beginning on page 30, line 20 has been changed as follows:

The above described information display and information input device may serve a number of functions. For example, as a touch screen where a user may respond to information displayed on the device by pointing at the device with a finger, stylus or other means with the information input function of the device then reading the information input by the user. The user may input information by for example pointing to an icon on the screen or writing on the screen. Such a touch screen could be used in a tablet PC, PDA, mobile phone, ATM, games console etc. The information display and information input device of the ~~present invention~~ disclosure is particularly suited to applications in mobile computing since in the same surface area the device provides both a relatively large area display and a

relatively large area input device with suitable software allowing the user to switch between the two functions or combinations of the two functions as appropriate.

The paragraph beginning on page 32, line 19 has been changed as follows:

No doubt the teaching herein makes many other embodiments of, and effective alternatives to, the ~~present invention~~ disclosure apparent to a person skilled in the art. The present invention is not limited to the specific embodiments described herein but encompasses modifications which would be apparent to those skilled in the art and lying with the spirit and scope of the attached claims.